The Iowa Policy Project

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EXECUTIVE SUMMARY

An Uncertain Future:

The outlook for Iowa communities and flooding as our climate changes

Scenes of flooding devastation replayed across Iowa this past spring. In the east, the Mississippi River reached flood-stage for 38 days, breaching a levee in Davenport. In the west, the Missouri River Basin took on more runoff in three months than it typically gets in a year. Floods breached 47 levees on the Missouri, including every Iowa levee south of Council Bluffs.[1] The total statewide damages estimate of $1.6 billion is likely to grow with further review. As flooding has broken records, so have temperatures and rainfall.

See the full report by James Boulter, Ph.D., on www.iowapolicyproject.org

This paper puts observations and trends about precipitation and temperature in the context of the latest climate science. It examines recent and robust predictions of future climates and the effects of climate change that are projected for the region, and seeks to answer these vital questions:

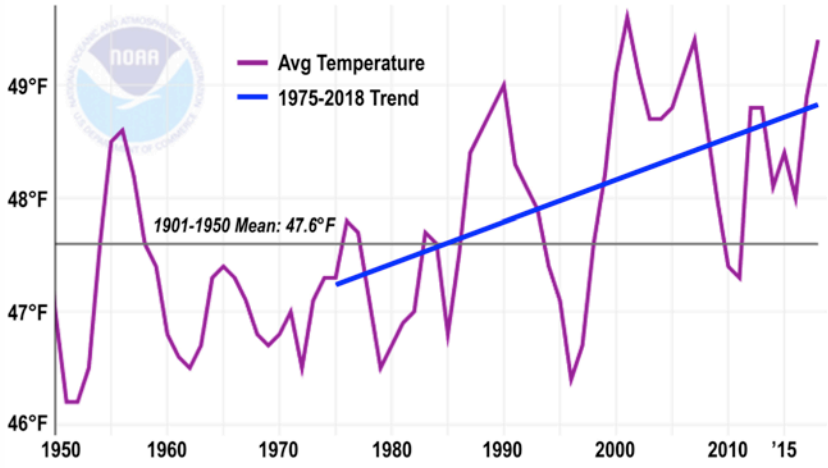
- In the face of our changing climate, will Iowa flooding worsen as the world grows warmer?
- What is the outlook for the next 10-30 years if only limited action is taken?

Historically hotter

The highest-confidence climate trend is the increase in average temperatures: overall, 0.4 °F per decade over the past four decades (right). Across the contiguous United States, most of this warming has occurred during the winter. However, the largest future warm-season temperature increases are projected to occur in the Midwest. Along with higher average temperatures, climate projections indicate that the hottest summer days will become even hotter.

Temperatures in Iowa are already increasing

Iowa, Average Temperature, 48-Month Period Ending in December



Source: National Climate Data Center, Climate at a Glance, 2019

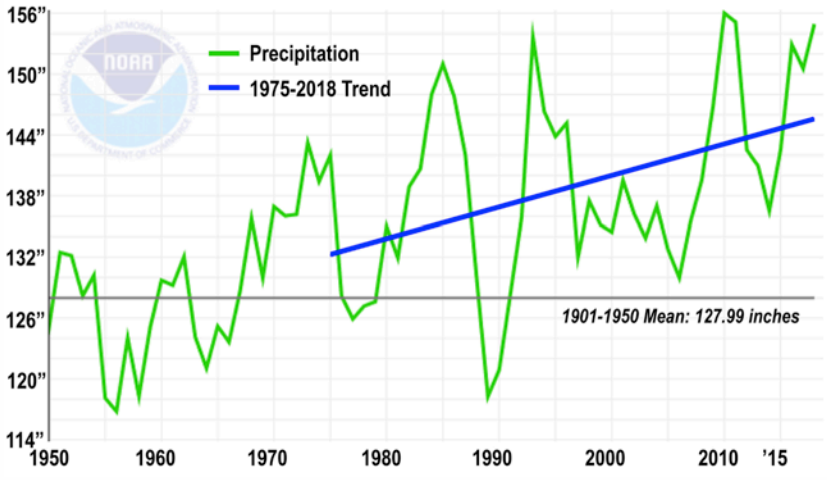
Historically wetter

During this spring, Iowa's precipitation of over 50 inches shattered its 116-year-old May to April record by over 2.5 inches. February snow accumulations were 3½ times its recent average. Snowfall in Minnesota and Wisconsin vastly exceeded norms, up to 40 inches above normal.[2] [3]

Since the mid-1970s, the average annual rainfall in the Upper Mississippi River Basin has steadily risen at a rate of almost one inch per decade. High-rainfall days have been more intense — a 42 percent increase in rainfall amounts across the Midwest in the top 1 percent of days with precipitation.[4] A range of climate models predict that by 2041-2050, there will be another 30 percent increase in the frequency of two-day precipitation events whose rainfall totals set a five-year record.[5]

Precipitation steadily up in the Upper Mississippi River Basin

Upper Mississippi River Basin Precipitation 48-Month Totals Ending in December



Source: National Climate Data Center, Climate at a Glance, 2019

Flooding is the greatest concern — but trends are harder to quantify

The highest profile and most costly outcomes of this year's historic precipitation events are the floods that devastated households, businesses, municipal and transportation infrastructure in communities across the state. In addition to the dramatic images of flooded roads, homes and downtown businesses, another form of flooding caused substantial harm to many of Iowa's farmers: field flooding. Inundation of farm fields forced some farmers to plant late or not at all, with spoilage of stored grain, deaths of livestock, and substantial damage to costly farm capital infrastructure. Less visible, but no less significant, impacts are to human health and well-being, which disproportionately affect those most vulnerable due to socioeconomic status, existing health conditions, and access to healthcare. These cover a wide range of concerns and include premature death directly resulting from extreme heat or floods, threats to human and environmental health from contaminated water supplies, the spread of disease-carrying insects, and harm to mental health due to loss of home and community.

For many Iowans, this year's floods appear to be a repeat of other recent "100-year flood" events such as 1993, 2008 and 2011, leaving them to wonder if this the way of the future in a changing climate.[6] This was answered in a recent report by the Iowa State University Institute for Transportation, which found: "For the Cedar River Basin in Iowa, the 100-year flood ... of the 20th century is projected to be a 25-year flood in the 21st century, with associated increased frequency of flooding of agricultural land."

Predictions of flood frequency and severity are generally less precise than those of increased temperatures and more frequent extreme rainfall events. Although it might seem intuitive that heavy rains would lead directly to flooding, the frequency or severity of individual floods is determined by a complex set of processes stemming from a variety of phenomena including climate change. Although projections for flooding are complicated, compelling studies offer sobering assessments of future hazards of inland flooding and potential costs due to related flood damages in the Midwest.

One detailed analysis of 18 downscaled global climate models (or "regional climate models") concluded that springtime conditions in the later third of this century may be consistent with those during the devastating 1993 floods of the Mississippi River Valley. During May and June of that year, over 17 million acres were flooded over a nine-state region (including every county in

Iowa), resulting in at least $2 billion (in 1993 dollars) in crop losses alone.[7] The study examined atmospheric phenomena that are conducive to forming large quantities of airborne moisture contained in particular air circulation patterns (termed "atmospheric rivers"). This paper predicted increases of 20 to 40 percent in springtime precipitation in the Upper Mississippi River Valley, consistent with other model predictions for the mid-century. In short, this study makes a compelling argument that a changing climate may produce more historic-level floods in the region and that the anomalous atmospheric conditions that led to the 1993 floods may become a new normal; this prediction should be of great concern to policymakers as well as citizens of Iowa.[8]

Policy responses

In one way or another, a policy response is inevitable. Leadership can move to lessen impacts of climate change on flooding, or respond to disaster after the fact. This report compares the Intergovernmental Panel on Climate Change future scenarios in which human society makes choices to mitigate its impacts on the global climate. The least ambitious response is consistent with some of the most alarming potential climate outcomes. Conversely, future climate impacts are greatly reduced in a more robust response that exceeds what the U.S. has previously committed to in the 2015 Paris Accord in emissions reductions.

The effects of climate change, in both rural and urban Iowa, are becoming increasingly clear. However, these impacts are still small compared with what is projected over the next few decades under moderate and higher emission scenarios, and almost insignificant compared to those projected to occur in the latter part of the century. It is incumbent on those who have the ability and responsibility to take immediate actions and overcome narratives of doubt and conflict. This issue demands prompt, science-informed policy responses to climate change.

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[1] Hardy, K. & Cannon, A., (22 March 2019) "Iowa flooding: Damage from floodwaters reaches $1.6B, Gov. Kim Reynolds estimates" Des Moines Register Retrieved August 2019 from https://bit.ly/2YdDx5S.

[2] NOAA National Centers for Environmental Information, (May 2019). National Climate Report - April 2019. State of the Climate, National Oceanographic and Atmospheric Administration, Retrieved August 2019 from https://www.ncdc.noaa.gov/sotc/national/201904.

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[4] Peters-Lidard, C, (August 2016). Heavy Precipitation. U.S. Global Change Research Program, Retrieved August 2019 from https://www.globalchange.gov/browse/indicator-details/3962/.

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[6] Anderson, C., Claman, D., and Mantilla, R., (2015) Iowa's Bridge and Highway Climate Change and Extreme Weather Vulnerability Assessment Pilot, Iowa State University, Institute for Transportation, https://bit.ly/2kHtGWX.

[7] Iowa Flood Recovery Coordination Team (1994) The Floods of 1993 Iowa Flood Disaster Report, Part 1. Accessed at: http://publications.iowa.gov/id/eprint/10120

[8] Cook, K.H., et al. (2008) "Springtime Intensification of the Great Plains Low-Level Jet and Midwest Precipitation in GCM Simulations of the Twenty-First Century" Journal of Climate, 21 (23) pp. 6321-6340. https://journals.ametsoc.org/doi/full/10.1175/2008JCLI2355.1.

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The Iowa Policy Project

The Iowa Policy Project is a nonpartisan, nonprofit organization that provides policy analysis and research to foster economic opportunity and health of Iowans and their environment. Reports are available at www.iowapolicyproject.org.